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Original Research Article

Perception and practices of solid waste management among adults in households and commercial establishments of villages under a sub centre, Bangalore urban district: a mixed methods study

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ABSTRACT

Introduction: Solid waste management in rural areas is laced with many challenges which involve multiple stakeholders. Objective was to explore the perspectives and practices of adults regarding solid waste management in households and commercial establishments of villages under a sub-centre, Bangalore Urban district.
Methods: A mixed method study (Quantitative and Qualitative) was conducted at a sub-centre area which caters to 10 villages of Bangalore urban district, Karnataka over a period of two months (January 2019 to February 2019). Quantitative data was collected from 200 adult participants while for the qualitative part a total of 2 FGDs and 10 IDIs were conducted.
Results: Mean age of the participants was 40.2±14.7 years and majority (83%) of them were female. Mean perception score of the participants was 6.7±2.4 out of a total of 14. The most commonly reported disposal methods were burning (51.5%) followed by dumping in open spaces (48%). Majority (96.5%) were willing to keep the streets clean, 53% were willing to segregate waste or compost (49%). Although the participants were aware of harmful effects of improper management of solid waste on environment and health, good practices were inadequate. Scarcity of appropriate dumping sites, lack of transportation facilities of waste to the dumping site and non-co-operation among the residents emerged as the barriers in solid waste management.
Conclusions: Lack of land availability and social consciousness among the villagers played a major role in solid waste management. Addressing this issue demands a intersectoral co-ordination with interventions directed at empowering the villagers and local bodies and enhancing their involvement in proper waste management.

Key words: Gram panchayat, Mixed method study, Rural area, Solid waste management

INTRODUCTION

Solid waste is unwanted material generated from combined residential, industrial and commercial activities in a given area.[1] Good solid waste management involves the sequential hierarchy of source reduction, reuse, recycling and safe disposal.[2] Waste management is the second most pressing matter after the problem of inadequate water quality within all developing nations.[3] Management of solid waste in developing countries is also affected by factors like poverty, population explosion and urbanization. A global review indicated that only 26% of waste from rural LMIC (Low middle Income countries) are collected as opposed to 48% from their urban counterparts.[4] A World Bank report in 2018 predicted a rise in global solid waste production to 3.40 billion tonnes by

2050.[5] It is estimated that people in rural India are generating 0.3 to 0.4 million metric tons of organic/recyclable solid waste per day. It has become a global problem which can affect both the environment and health of the people. Dumping of waste near water bodies and open grounds can cause water and soil pollution. A total of 80 percent of all diseases spread within a community in a developing country are believed to be connected to the poor waste management in small towns and rural areas.[2] Solid waste is also cleanliness and hygiene issue. Overloaded public bins not only cause foul smell but also attract rodents and mosquitoes causing spread of diseases in the community. With lesser access to quality healthcare, this can result in high morbidity and poor outcomes among the rural population.[6]

India is one of the fastest developing economies, but when it comes to WASH indicators, it continues to lag behind.[5] With a population of over 1.2 billion, there is a mounting and urgent need to address sanitation. Solid and Liquid Waste Management (SLWM) is one of the key components of Swachh Bharat Mission (SBM) launched with the objective of bringing improvement in cleanliness, hygiene and the general quality of life in rural areas. The Gram Panchayat functionaries would be responsible for design, implementation, operation and maintenance of SLWM systems with support from respective state governments. Waste management is not only a policy level problem but also behavioral problem at individual level. Attitudes and beliefs of people such as not in my backyard can have great impact on how the waste is disposed. Therefore, understanding the enablers and barriers for solid waste management at individual level and also at institutional level is utmost important. There is paucity of literature on this important topic of public health importance in India. Hence this study aims to assess the perception and practices of solid waste management among the adult men and women of sub-centre area and also to determine the associated factors.

METHODS

This was a mixed method study (Quantitative and Qualitative) conducted at a sub-centre area which caters to 10 villages of Bangalore urban district, Karnataka over a period of two months (January 2019 to February 2019). The study population consisted of adults residing in the study villages. The sample size for the quantitative part was calculated as 185, taking 5% absolute precision and 95% confidence limits, based on a previous study done in Bangalore by Kumar et al where 14.2% had positive perceptions about solid waste management.[7]

This was rounded off to 200. A list of total number of households in the ten villages was obtained from HMIS (Health Management Information system) of the sub centre which accounted to 1416. On dividing the total number of households with desired sample size, a sampling interval of 7 was obtained. Systematic random sampling was done proportionate to number of households in each village and a list of 200 households was obtained. Standing at the centre of each village, a coin was flipped to decide the direction in which data collection should start. In that direction the first house was randomly selected by lottery method using chits and next house was selected by adding a sampling interval of 7. If any house was locked, the house next to it was included. Quantitative data was collected from one adult member of the selected household available (above 18 years of age) at the time of interview. All seriously ill patients and those who were unable to comprehend the questions (due to old age or mental health issues) who were available at time of interview in selected household were excluded from the study. In case of any house being locked, next house in the list will be taken for the collection of data. After explaining the purpose of the study, a written informed consent was taken from the participants, and the face-validated, pre-tested study tool was administered. The study tool was a 58-item semi-structured interview schedule consisting of14 questions on socio-demographic details, 21 questions on perception and 23 questions on practices regarding solid waste management. Out of the 21 questions on perceptions, 14 were scored, with one point allotted for a positive perception. Participants with higher perception score was considered to have positive perception. For the qualitative part two focused group discussions (FGD) and 10 key informant interviews were conducted. Topic guides were prepared on perceptions of study participants on solid waste management. The participants for each FGDs were homogeneous groups of adult residents of the sub centre Key informant interviews were conducted with the owners of commercial establishments and members of local governing bodies in the local language.

Statistical analysis

For the quantitative part data collected was entered in Microsoft Excel 2010 and analyzed using standard statistical package. Socio-demographic profile of the study participants and their perceptions and practices regarding solid waste management were described using frequencies, proportions, mean and standard deviation.

The association between perceptions and practice of solid waste management and various socio-demographic factors using Chi-square test of association. A p value of <0.05 was considered significant. For the qualitative part, thematic deductive analysis was done by coding the responses of the interviewees and the themes and subthemes that emerged were documented

RESULTS

Quantitative

A total of 200 people were interviewed each being a representative of one household. Among those interviewed 83% were female between the age range of 31-60 years and a mean age of 40.16±14.79 years. A quarter (26.5%) of those interviewed had no formal education, 41.5% were

gainfully employed, 31.1% belonged to middle class (according to modified BG Prasad socio-economic scale 2019[8] with a median per capita income was Rs 2000 (1000-3000) per month.

Table 1: Socio-demographic details (n=200).

Socio-demographic variables	Total, N (%)	Male, N (%)	Female, N (%)
Age groups (years)			
18-30	63 (31.5)	9 (4.5)	54(27.0)
31-60	117 (58.5)	21 (10.5)	96(48.0)
>60	20 (10.0)	4(2.0)	16(8.0)
Educational Status			
No formal education	53 (26.5)	6(3.0)	47(23.5)
Upper primary school	31 (15.5)	4(2.0)	27(13.5)
High school and above	116 (58.0)	24(12.0)	92(46.0)
Occupation			
Not gainfully employed	119(59.5)	3(1.5)	116(58.0)
Employed	81 (41.5)	28(14.0)	50(25.0)
Total	200 (100)	34 (17)	166 (83)

Table 2: Perception regarding solid waste management (n=200).

Perception	Proportion reported, N (%)
Able to explain the constituents of solid waste?	126 (63.0)
Able to explain importance of recycling	64 (32.0)
Able to explain importance of composting	167 (83.5)
Able to explain importance of waste segregation	136 (68.0)
Able to state any two problems caused by improper solid waste disposal	122 (61.0)
Able to name any two diseases caused by improper waste disposal	171 (85.0)
Able to name any one Government scheme for SWM	86 (43.0)

Table 3: Association of socio-demographic factors with perception score (n=200).

Variables	Total	Low perception score, N (%)	High perception score, N (%)	P value
Gender				
Male	34	21 (61.8)	13 (38.2)	0.38
Female	166	93 (56.0)	73 (44.0)	
Education				
No formal education	53	36 (67.9)	17 (32.1)	0.04
Primary level education	31	23 (74.1)	8 (25.9)	
High school and above	116	55 (52.4)	61 (47.6)	
Total	200	114 (57.0)	86 (43.0)	

Perception

The mean perception score (SD) of the participants was 6.7±2.4 and maximum score obtained by any participant was 11 out of 14. Around 86 (43.0%) of the participants had a positive perception regarding solid waste management. There was no difference in perception scores between males and females. Mosquito borne infections (including Dengue and chikungunya) (46.5%), fever (30%), asthma/acute respiratory tract infections (n=37) and diarrhea (n=25) were reported as health implications of improper solid waste management. We also assessed the willingness on the study participants to take action on solid waste management. An overwhelming majority (96.5%) was willing to keep the streets clean, approximately half were willing to segregate waste (53%) or compost (49%). Only one third of the study participants felt that the panchayat measures for waste management were adequate (33%) and another one third were willing to pay to ensure safe solid waste disposal practices (34%). Less than one fifth of individuals were willing to recycle (17%).

Practice

The most commonly reported solid waste generated at the domestic level was kitchen waste (79%) followed by paper/books (11%). Majority of the households (78%) households had a storage receptacle for waste with nearly equal proportions reporting open (31.5%) and closed bins (34%). Almost (60%) of all households reported waste segregation and (49.5%) practiced composting. The most commonly reported disposal methods were burning

(51.5%) followed by dumping in open spaces (48%). Other reported methods included man-made waste pits (18.5%), disposal in a water body (5.5%) and disposal in public dust bins (9%).

Table 4: Perceptions on solid waste management (n=200).

Perceptions	Positive attitudes, N (%)
Willingness to recycle	34 (17)
Willingness to compost	99 (49.5)
Willingness to segregate	106 (53.0)
Willingness to pay for waste collection services	68 (34.0)
Willingness to keep their streets clean	193 (96.5)
Attitude regarding measures taken by local authorities	66 (33.0)

Table 5: Key Themes and subthemes.

Key Themes	Subthemes
Theme1: Waste management practices	Household practices, Authority practices, Community practices, Disposal of sanitary napkins, Misconceptions, Effect on health and environment
Theme2: Difficulties in solid waste management	Lack of system in place, Social responsibility
Theme3: Role of local governing bodies	Expectations from Panchayat, Challenges faced by Panchayat

Qualitative

A total of 2 FGDs were conducted separately with men and women of sub-centre. A total of 21 people participated in the FGDs out of whom 11 were females and 10 were males. A total of 10 IDIs were conducted with the owners of commercial establishments and panchayat (local governing body) members. Sessions typically lasted 30-45 minutes. The analysis of textual data resulted in the emergence of interrelated themes, underpinned by subthemes. A total of three themes and ten subthemes emerged from the data. Waste management practices emerged as the major key theme. The next key themes that emerged from our data were difficulties in management of solid waste and role of local governing bodies.

Theme 1: waste management practices

Subtheme 1: Household practices; Participants of the FGD reported that most of the villagers practiced segregation of waste into dry and wet waste. Wet waste comprised mainly of kitchen waste or food leftovers, and dry waste comprised of paper and plastic. They separate waste so that cattle in the village can be fed wet waste as "Kudithi" and few use it as manure. Dumping, burning and throwing into lake are the prevalent practices of waste disposal and waste is collected in plastic covers from the household and it is disposed in one of the above ways. Most commonly reported waste materials burned include plastic or paper packaging material, neighbourhood organic waste (dry leaves or twigs) and menstrual waste. One of the key informants informed that in a nearby village, a local NGO donated push-to-open dustbins to every house in the village but people have stopped using them as there is no proper waste collection system. "We throw waste in plastic covers once in three days near the kerekatte." Subtheme 2: Authority practices; The most commonly reported negative comments about authority figures showed a repeated dissent against false promises and perceived money laundering most commonly for the cleaning of drains. Other unkept promises included providing facilities for waste disposal through the provision of a tractor. "Once a year, during the Village festival, 'Jaathra'(local fair), they clean all the drains, make a bill of50, 000-60,000 rupees out of which they pay rupees 20,000 to them and keep 30,000 to themselves. They put bleaching powder once a year into drains.

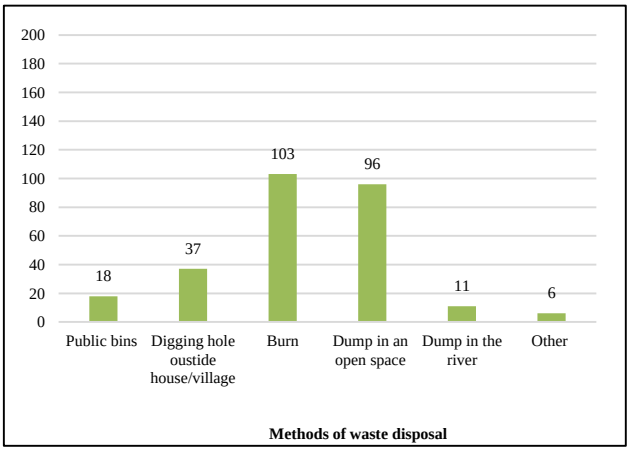

Figure 1: Methods of solid waste disposal (n=200).

They get a lot of bleaching powder from government. But they don't give it to us." One key informant noted that a failed attempt was made at disposing waste by providing acommon dumping area in the form of a cement ring. However, untimely clearance by the authorities resulted in waste overflow, attracting animals and rodents, and producing an offensive odour "Previously, we had a facility where the Panchayat had put one cement ring where people used to dump the waste but it became full in one day and there was nobody to collect the waste from it. Dogs went and took all the covers and papers from it and the waste got scattered in front of our houses."Subtheme 3: Community practices; Waste generated from the local market "Santhe" is collected in bags and dumped in an open place far from the village at the end of the day. Two key informants noted that scrap dealers do collect waste materialand spare parts including cardboard (carton) boxes, for which they were paid a nominal amount. Popular dumping sites for commercial establishments

include open spaces, fields and around the local lake. A variety of waste was reported to have been dumpednear the lake including electronic waste tubes/glass/plastic casings of television sets, restaurant waste including non-vegetarian food waste and alcohol bottles. Waste disposal in domestic drains also appeared to be a point of contention for a few. Subtheme 4: Disposal of sanitary napkins; Most village women of younger generation used sanitary napkins while the older women used clothes and they disposed them near the lake or they would burn it. "We use cloths, we wash it and dry it and re-use for one year. After that, we throw it near the lake and use new cloth." Subtheme 5: Misconceptions; The villagers had some misconceptions regarding waste management. One of the participant said that adding turmeric to the plastic will decompose it faster and some even felt that panchayat should provide a place to burn the waste. "It would be nice if the panchayat provides a place to burn waste." Subtheme 6: Effects on health and environment; The participants were well aware that if waste is not managed properly, it will attract mosquitoes and flies which in turn can lead to diseases. They also stated it creates dog nuisance and gives bad smell. One of the key informants was aware that burning of waste causes air pollution and also leads to cancers.

Theme 2: Challenges in solid waste management

Subtheme 1: Lack of systems in place; The participants complained that they don't have enough spaces to dump the waste and also they have difficulty in transportation of the waste to dumping sites. They also opined that there should be waste collectors and a tractor in the village to collect the waste like in Bengaluru city which is nearby. They also state that they could do without plastic bags but they are only using it because of its easy availability and convenience. They felt that government should formulate strict laws for ban of plastic. "When I go to buy bananas, they give me in a paper bag and it tears off. So I personally go searching in 3 shops to get a plastic bag. So, if they stop manufacturing, why will I go searching for it? Now, government has given license for liquor shops and tells everyone not to drink. And even on the bottles, it's written "don't drink". That's our situation." Subtheme 2: Social responsibility; One of the participant opined that all the participants of the FGD should go and meet subcentre and discuss their problems regarding solid waste management, while one of them said that Panchayat is only responsible for keeping the streets clean and it's the responsibility of villagers to keep their houses clean. They also admitted that there is non-cooperation among residents of the village. "It is better to spend money on solid waste management than to spend money for treatment of diseases".

Theme 3: Role of local governing bodies

Subtheme 1: Expectations from the Panchayat; Most of participants from FGDs and IDIs are of the opinion that the local panchayat under which the subcentre comes does not do enough in terms of waste management. They feel that panchayat should conduct awareness sessions like health education, street plays, door to door house visits and also release funds for solid waste management. They want the panchayat to keep a tractor and driver who can collect waste twice a week and also should provide appropriate places for dumping the waste. Subtheme 2: Challenges faced by the panchayat. The members of the local governing body reported that land acquisition for dumping of waste is in process and there were legal troubles in acquisition. They also felt that funds are meagre and people don't have accountability as they threw waste in drains inspite of repeated notices. "Our panchayat has been declared Open Defecation Free last October.After that we don't get any funds. We have given requisition for land arrangement. We also plan to deploy tractors and men for solid waste collection."

DISCUSSION

Our study documented the perceptions and practice of adults regarding solid waste management in rural subcenter area of Karnataka. Our results show that at individual level people were well aware of solid waste management and its importance but at community level there was no collective motivation or action for proper waste management. This further signifies the role of different stakeholders for formulating amicable solutions in long run. Less than half of the participants in this study had positive perceptions regarding solid waste management which is in consistent with findings of study conducted by Arora et al where 46% had adequate awareness.[9] More than half the participants segregate waste in this study which is much higher compared to community based study done in Mangalore where only 35% segregate waste.[1] These reasons for this contrast could be explained by findings from qualitative analysis where the villagers reported they segregate waste so as to feed their cattle and also for agricultural purposes. Less than one fifth of the participants had awareness about recycling which is similar to a finding in a study done in Tonga where only 13% had awareness about recycling.[10] Regarding attitudes, almost 96.5% of the participants were willing to keep their streets clean while only 35% of them were willing to pay if such system is ensured. This finding is similar to study conducted in Bangalore urban where 30.5% were willing to pay for waste collection from their household.[7] The reasons for this finding could be villagers opining that it is the responsibility of the local authorities as discussed from the qualitative results. The most common methods of waste disposal included burning and dumping of waste. This finding is consistent with a study done in Assam and Somalia where burning, dumping, burying were major methods of waste disposal. These practices were harmful as they caused contamination of local water bodies and air pollution.[11,12]

Majority of the participants were able to name two diseases caused by improper waste disposal which explains that they were aware of the importance of proper waste

disposal, findings from qualitative analysis suggests that lack of proper system in place for waste collection and disposal results in harmful practices.

Less than half of the participants were being aware of government schemes such as Swachh Bharat Mission for solid waste management which further aggravate the problem. The qualitative results highlight the different practices at different levels of community ownership and also relate to the reasons for such practices. Age old practice of using clothes for menstruation continued among the village women especially older generation which is another cause of concern as these practices can result in gynecological problems among women. Misconceptions should be removed by appropriate scientific education and also good practices such as selling of waste materials for recycling by commercial establishments should be reinforced at Village Health Sanitation and Nutrition days as positive deviance. Most of the participants were aware of harmful effects of improper waste management and opined that permanent system in place could only solve this important public health problem. This includes door to door collection by tractors through local body and disposing it in a designated area. There were expectations from the local authorities in the form of utilizing the funds properly for solid waste management and also villagers opined that there should be representation in this regard from the village population. The solution offered by an NGO in form of providing waste collection bins was of temporary use without any long term sustainability.

Implications

Based on our study, we found that ownership at Gram panchayat level and community involvement is important in tackling this problem. Information, Education, and Communication (IEC) interventions in the form of role plays can create a demand for a sustainable system. Awareness and education campaigns should aim for panchayat officials, self-help groups, schools, nongovernmental organizations (NGOs) working in these villages, shop keepers, families, and general public. Apart from composting, identifying an appropriate technology through third party can be explored for Solid waste management in Mugalur Subcenter area. Funds provided under SBM along with other opportunities; Corporate social responsibility, Mahatma Gandhi National rural employment guarantee scheme (MGNREGS) can be utilized for maintaining a sustainable system. Adolescent girls could be utilized as change makers for recycling and reusing the waste materials by existing self-help groups. Accountability among villagers is essential to curb this menace. The efforts from local authorities compounded by co-operation among villagers instead of blame game can only result in practical solutions to this problem. The future research should focus on challenges at programmatic level and at administrative level. Also monitoring and evaluation components should be focus of interest for sustainable solid waste management in rural areas.

Limitations

Limitations were; due to time constraints only two focused group discussions were conducted nevertheless the data obtained through it gave new insights into this important topic of public health importance.

CONCLUSION

Although our study participants had positive attitude for waste management, in practice they were not following it. The enablers and barriers for good solid waste management in a rural setting included community engagement and lack of waste management policy, not exploring the option of outsourcing.

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